necessitated by too great haste in formulation and too great rashness in publication. The freedom to change which he exercised, and which was exercised too little by at least one of his predecessors, was an offset to his rashness. He exercised a proper scientific spirit in refusing to be always consistent at the expense of truth."

We have received copies of addresses delivered before some of the sections:—"A Chapter in the History of Mathematics" was the subject of an address delivered before the section of Mathematics and Astronomy, by Prof. W. W. Beman. An interesting address was delivered before the section of Physics, by the vice-president, and chairman of the section, Dr. Carl Barus, upon the subject of "Long Range Temperature and Pressure Variables in Physics." The section of Chemistry received an address from Prof. W. P. Mason, upon "Expert Testimony," which is practically a handbook for experts. Prof. J. Galbraith addressed the section of Mechanical Science and Engineering, upon "The Groundwork of Dynamics." The section of Botany listened to an address upon "Experimental Morphology," by Prof. G. F. Atkinson.

Papers of interest were presented in each section. The Physics section was unusually full, and received a large proportion of electrical papers. Two professors from the Weather Bureau read papers: Prof. Frank H. Bigelow, on international cloud observations made by that bureau; and Prof. C. F. Marvin, on kites and their use by the bureau in exploring the upper air. One or two joint sessions of this section and the mathematical section were held. Several joint sessions of other sections took place. A debate on evolution was conducted before the joint session of botanical and zoological sections by Prof. Henry F. Osborn and Prof. E. B. Poulton. The zoological section was specially interested in the notes on a collection of Cephalopods from the *Albatross* expedition, by Mr. Wm. E. Hoyle, Keeper of the Manchester Museum. Prof. L. O. Howard was elected vice-president of this section, to fill the vacancy caused by death of Prof. G. Brown Goode. Prof. Howard's address as vice-president was on the distribution of species by man, with particular reference to insects. He also read other papers; and was elected permanent secretary of the Association, in place of Prof. Putnam.

A joint session of the geological and anthropological sections was held to discuss the discoveries of argillite implements near Trenton, by Prof. Putnam. Profs. Putnam and Wright maintained that these discoveries proved the existence of palæolithic man; an inference disputed by others.

Startling conclusions with reference to the region where the Association met, were presented to the geologists by Dr. J. W. Spencer and Prof. G. K. Gilbert, who by joint labour and investigation had determined that the earth's surface about the great lakes is sinking at nearly the rate of one inch in ten years, as Dr. Spencer says. Prof. Gilbert adds that the rise is more rapid towards the north and east, amounting to five inches in a century in points 100 miles apart. The result will be that in a few centuries Chicago and Detroit will be flooded; within 1000 years water will flow freely from Lake Michigan into the Mississippi, and within 3000 years Niagara will be dry, and the St. Lawrence will drain only the Lake Ontario basin. Prof. E. W. Claypole was elected to preside over this section in the absence of the vice-president.

The time and place of the next meeting, fifty years after the formation of the Association, will be Boston, August 22, 1898; at which city arrangements were made in 1847 to meet at Philadelphia in 1848, and then to change the old Association of American Geologists and Naturalists into the American Association for the Advancement of Science.

The following were nominated as officers: President, Prof. Frederick Ward Putnam, of Cambridge, Mass. Permanent Secretary, Prof. Leland O. Howard, of Washington, D.C., Government entomologist. General Secretary, Prof. D. S. Kellicott, of Columbus, Ohio. Secretary of the Council, Prof. Frederick Bedell, of Ithaca. Treasurer, Prof. R. S. Woodward, of New York. Vice-Presidents: Section A (Mathematics and Astronomy), Prof. E. E. Barnard, of the University of Chicago; Section B (Physics), Prof. Frank D. Whitman, of Cleveland, Ohio; Section C (Chemistry), Prof. Edgar F. Smith, of Philadelphia; Section D (Mechanical Science and Engineering), Prof. Wm. E. Cooley, of Ann Arbor; Section E (Geology and Geography), Prof. H. L. Fairchild, of Rochester, N.Y.; Section F (Zoology), Prof. A. S. Packard, junr., of Providence, R.I.; Section G (Botany), Prof. W. G. Farlow, of Harvard University; Section H (Anthropology), Prof. J. M. Cattell, of New York; Section I (Economic Science and Statistics), Mr. Archibald Blue, of Toronto, Canada. Secretaries of Sections: Section A, Prof. Alexander Ziwet, of Ann Arbor; Section B, Prof. E. B. Rosa, of Middletown, Conn.; Section C, Prof. Charles Baskerville, of the University of North Carolina; Section D, Prof. W. S. Aldrich, of Morgantown, W.Va.; Section E, Prof. Warren Upham, of St. Paul, Minn.; Section F, Mr. C. W. Stiles, of Washington, D.C.; Section G, Mr. Erwin Smith, of Washington, D.C.; Section H, Dr. M. H. Saville, of New York; Section I, Dr. Marcus Benjamin, of Washington, D.C.

NOTES.

AS already announced, the sixty-ninth meeting of German men of science and physicians will take place at Brunswick on September 20 to 25. On the Sunday before, September 19, there will be a display of popular and juvenile games on the Bernhard Platz, in the afternoon. In the evening the first general reception will take place. There will be two general meetings, on September 20 and 24 respectively, at 9 a.m. Prof. Richard Meyer (Brunswick) will give a paper on the relations between chemical research and chemical technology, and Prof. Waldeyer (Berlin) on impregnation and heredity, on the Monday. At Friday's meeting, September 24, there will be a lecture by Dr. Orth (Göttingen), on medical instruction and practice; and by Dr. H. Meyer (Leipzig), on the sources of the Xingu river, Central Brazil. The sections will begin to meet on Monday afternoon, September 20, but on Wednesday there will be a joint meeting of the sections on the subject of scientific photography, for which some highly interesting papers are promised by Prof. H. W. Vogel, René du Bois-Reymond, Lassar, Selenka, and others. The evenings throughout the week will be enlivened by operas, concerts, and balls, and excursions are arranged to Wolfenbüttel, Königslutter, and other attractive places in the neighbourhood.

THE Imperial Leopold-Carolina Academy of Halle has awarded the Gold Comenius Medal to Prof. A. von Kölliker, professor of anatomy in Würzburg University, who recently celebrated the completion of his eightieth year and the jubilee of his appointment to the chair he occupies.

IT is announced in the *Times* that Sir Robert Giffen, K.C.B., F.R.S., Controller-General of the Commercial, Labour, and Statistical Department of the Board of Trade, having reached the age at which he is at liberty to retire from the Civil Service, has decided to do so. The Board of Trade will thus lose his invaluable services; but Sir Robert Giffen will be given more leisure to complete some important studies upon which he has lately been engaged.

IT is stated that Prof. Koch is about to return to South Africa to carry out further experiments in relation to rinderpest.

THE *British Medical Journal* states that one hundred sets of Röntgen ray apparatus are to be supplied to the Army Medical Department.

WE learn from the *Revue Scientifique* that the late M. J. Jackson left a sum of one hundred thousand francs to each of the following organisations:—Société nationale d'acclimatation, Société de linguistique, Société géologique de France, Société française de photographie, Association française pour l'avancement des sciences, Société astronomique de France.

WE regret to announce the following deaths:—Dr. Karl Vogel and Prof. Wilhelm Liebenow, the veteran German cartographers; Prof. Karl Wilhelm Petzold, of Brunswick, known by his works on physical and astronomical geography; Dr. Theophil Chudzinski, a member of the Paris Anthropological Society, and a frequent contributor to its bulletins and the *Revue d'Anthropologie*; Dr. J. H. Trumbull, a distinguished philologist and a member of the U.S. National Academy of Sciences, and Dr. Jules Bernard Luys, member of the Paris Academy of Medicine.

THE National Photographic and allied Trades Exhibition will be held in the Portman Rooms, Baker Street, London, W., in April next. It is to be a manufacturers' exhibition of photographic, lantern and optical apparatus and accessories, and it will be open to the public as well as to dealers. Mr. Arthur C. Brookes is the acting secretary to the exhibition, and applications for space should be addressed to him at Temple House, Temple Avenue, London, E.C.

THE State of Indiana has undertaken to defray the expense of publishing annually the *Proceedings* of the Indiana Academy of Science, and the two reports, for the years 1894 and 1895, for the printing and publication of which the State has paid, have just come to hand. By publishing the proceedings of the Academy the State secures, without further expenditure, the service of a number of investigators working in various departments of science, and spending a large portion of their time upon new problems the solution of which is of importance to the development of the Indiana commonwealth. These investigators, who constitute the best authority in the State upon their several subjects, will act without pecuniary compensation with the legislative body of Indiana, just as the National Academy of Sciences acts in conjunction with the U.S. Congress; they will freely advise the legislators when consulted upon scientific subjects, and assist in giving direction to scientific investigations undertaken by the Legislature as a basis for logical laws. The work of an Academy like the Indiana Academy is an important factor in developing mineral, vegetable, and animal resources, and it greatly strengthens educational agencies. The State has thus acted wisely in giving encouragement to the scientific workers within its borders, and doubtless the funds it has undertaken to provide will be returned a thousand-fold.

THE recent meeting of the Association of Agricultural Colleges and Experiment Stations in the United States cannot fail to be productive of good. "It brings out forcibly," says the *American Naturalist*, "the endeavours of Americans as a people to ameliorate the conditions of the agricultural classes, reminding us, as it does, that some 1,890,000 dols. were granted by Congress for the fiscal year ending June 30, 1898, for agriculture. Of this, something like 1,170,000 dols. is for scientific investigations under the direct supervision of the Department of Agriculture, and the rest (720,000 dols.) for maintaining the experiment stations. The departmental divisions falling within the domains covered by the American naturalist receive various amounts as follows: botany, 23,800 dols.; agrostology, 18,100 dols.; forestry, 28,520 dols.; pomology, 14,500 dols.; physiology and vegetable pathology, 26,500 dols.; biological survey, 27,560 dols.; entomology, 29,500 dols.; the bureau of animal industry, 755,640 dols.; and for special investigations in nutrition, under the auspices of the office of experiment stations, 15,000 dols."

FOURTEEN electric cabs commenced to "ply for hire" in the streets of London as ordinary licensed hackney carriages on Friday last. The *Electrician* gives the following particulars of the new vehicles:—The battery used on each of the vehicles consists of a set of 40 accumulator cells having a capacity of 170 ampere-hours when discharged at a rate of 30 amperes. It is estimated that on the level the current required, when the controller is placed at "full speed," is 24 amperes, and that on a fair incline, at about one-third that speed, this current is not exceeded. Steeper gradients require up to 30 or 35 amperes. The battery is carried in a tray, which is slung under the bottom of the cab by four suspension links supported by springs under compression, and the ordinary carriage springs again separate the cells from the vibration to which the carriage wheels are exposed. The motors have been specially designed for these cabs. They are of the Johnson-Lundell type, and supplied from America. The fields have two similar windings, and the armatures have also two similar sets of windings and two commutators. This doubly-wound motor is connected to a series-parallel controller of the usual American pattern in exactly the same way as the two motors of a tramcar would be connected to it. The cabs can be made to run at about one, three, seven, or nine miles an hour, and can move backwards. The whole of the movements are produced by the use of one lever placed at one side of the driver's box. It was originally estimated that two sets of cells would be required to enable the cab to do an ordinary day's work in the streets of London, it being considered that one set would propel it about thirty-five miles. The economy of the motor and controller arrangements, however, is so considerable that it is now found the cabs will do at least fifty miles with one set of cells without recharging, and the economy in the use of current thus experienced will make the running of the cabs cheaper than was originally expected. The cells are now charged at a central station; but as the service increases, charging stations in several parts of London will be required.

WE learn from the *British Medical Journal* that a Bill has been introduced into the Legislature of Brazil offering a prize of 220,000 dollars (44,000*l.*), to be divided into two equal parts, which are to be awarded to the author of a work demonstrating the existence of a bacillus of yellow fever and the method of recognising it, and to the discoverer of an efficacious means of treating the disease. The Medical Institute of Rio Janeiro, the Hygienic Institute of Berlin, and the Pasteur Institute of Paris are to decide as to the award of the prizes. The Bill further provides for the reservation of a sum of 110,000 dollars (22,000*l.*) to be applied to the creation of an establishment for the preparation of a curative serum, the discoverer of which will be appointed organising director of the institute. The former of these prizes will probably be awarded to Dr. Sanarelli, an account of whose researches on the etiology of yellow fever was given in NATURE of July 15 (p. 249). In the meantime, the Uruguay Legislature has conferred honorary citizenship on Dr. Sanarelli in recognition of his discovery of the microbe of yellow fever, and has voted him a grant of 10,000 dollars.

THE view advanced by Gervais and Lucas, that the reproduction of *Scolopendra* is ovo-viviparous, has remained uncontradicted up to the present time. Signor Filippo Silvestri, writing in the *Atti dei Lincei*, now states that on July 3 of last year he discovered a specimen of *Scolopendra cingulata* carefully guarding its eggs under a stone, and in June of this year he has found several specimens with their eggs. It is thus proved that *S. cingulata* is truly oviparous. The centipede protects its eggs by covering them with its body, and does not abandon them unless violently molested. The ova are pale yellow and of ellipsoidal shape, measuring 3 mm. by 2·5 mm., and the statements of Gervais and Lucas were probably based on the observations of others, who were led to infer that the *Scolopendræ* were viviparous by the careful way these had concealed their ova.

THE *Meteorologische Zeitschrift* for July contains an interesting article by Dr. J. Maurer, of Zürich, on the periodicity of cold and warm summers, based upon a discussion of the Berlin temperatures since 1728, and other trustworthy data. Among the most important papers bearing upon this subject in recent years, and to which due attention has been given in the present investigation, are (1) Köppen's eleven-year period of temperature; (2) Hellmann's uniformity of weather changes in successive seasons; (3) Lang's secular weather conditions as causes of glacier movements; and (4) Brückner's variations of climate since the year 1700. The author considers that the investigation decidedly shows that in the secular variations of temperature the warm summers are often followed by the mildest winters, during the great periods of relative warmth, and that during the cold periods, the severest winters often occur after cool summers. As it seems probable that the same rule will hold good in the future, as obtained in the past, it may be expected that the next great period of relative warmth, which should begin about the end of the present century, will be marked by a series of warm summers, with occasional very mild winters, in Western Europe.

WE have received the *Sitzungberichte der K. Academie d. Wissenschaften* (Band. cv.), containing papers read before the Vienna Academy of Sciences in 1896. Among the numerous papers printed in the various parts into which the volume is divided, according to the sections before which they were read, we notice the following:—The secular acceleration of the moon, by the late Dr. E. v. Haerdtl: a discussion of observations of two large meteors seen on January 16 and 25, 1895, and an estimation of their paths, by Prof. G. v. Niessl; the influence of selective absorption on the extinction of light in the atmosphere, by Prof. J. v. Hepperger; the deflection of kathode rays, by G. Jaumann; the ultra-violet spark-spectra of metallic elements, by Prof. Franz Exner and E. Haschek. The results now described and illustrated by heliogravure reproductions of photographs are in continuation of those given in the preceding volume. The lines investigated are comprised between about $\lambda = 2200$ and $\lambda = 4600$. Further studies of projectiles, by Dr. Ludwig Mach. This paper is illustrated with several fine reproductions of photographs of moving bullets. On the indispensability of atomism in science, by Prof. Ludwig Boltzmann; magnetisation in two dimensions and hysteresis in a rotating field, by Prof. August Grau and Dr. Richard Hiecke; on the deviation of saturated water-vapour from the Marriott-Gay-Lussac law, by O. Tumlirz; on the effect of low temperatures (down to 0° C.) upon the transpiration of plants, by Hans. Molisch; on the scaling of the reproduced tail in lizards, by Dr. Franz Werner; geo-morphological observations in Norway, by Dr. Eduard Richter; morphological and biological investigations of lichens, by H. Zukal; physical-oceanic investigations in the Red Sea, by Prof. J. Luksch; remarks upon some problematic fossil structures, by Theodor Fuchs; new fossil plants in the Radoboj collection of the Liège University, by Prof. C. v. Ettingshausen; geological exploration of North Greece, by V. Hilber; zoological results of the expedition of the *Pola* to the northern part of the Red Sea, by Dr. F. Steindachner; on the blood corpuscles of vertebrates, by P. Knoll; the absorption of bacteria after local infection, by Dr. J. Halban; on the comparative anatomy of the larynx of mammals, by Dr. H. Albrecht; synthetic investigations of topaz, by A. Reich; on the occurrence of argon in the gases from a spring at Perchtoldsdorf, near Vienna, by Dr. Max Bamberger. Many other chemical papers (mostly organic) appear in Abtheilung ii.*b* of the volume just published.

THE additions to the Zoological Society's Gardens during the past week include a Black-eared Marmoset (*Hapale penicillata*) from South-east Brazil, presented by Mr. Samson Clark; a Laughing Kingfisher (*Dacela gigantea*) from Australia, presented by Mr. W. L. Chrystie; a Painted Terrapin (*Clemmys picta*) from North America, presented by Mr. C. R. Fisher; an Algerian Tortoise (*Testudo ibera*) from North Africa, presented by Captain A. Carpenter, R.N.; a Black-headed Lemur (*Lemur brunneus*, ♀) from Madagascar, two West African Love Birds (*Agapornis pullaria*) from West Africa, deposited; a Golden-crowned Conure (*Conurus aureus*) from South-east Brazil, purchased; a Yak (*Pæhagus grunnieus*, ♀), a Wapiti Deer (*Cervus canadensis*), two Saffron Finches (*Sycalis flaveöla*), two Crested Pigeons (*Ocyphaps lophotes*), two Triangular Spotted Pigeons (*Columba guinea*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

NEW SOUTHERN VARIABLES.—Dr. Gill records the discovery of four new variable stars by Mr. R. T. Innes at the Cape Observatory (*Astron. Nachr.*, No. 3441). The first three have a variation of about 1 magnitude, while the range of the fourth is as yet uncertain. Here are the facts:—

Star.	R.A. (1875·0) h.	m.	s.	Decl. (1875·0)	
C P.D. −32°·1376	7	4	46·4	−32 43·6	Mags. 9·0–9·7
Cord. LC. 8·679h.	8	8	16	−34 12·1	„ 6·8–7·8
Th. −27°·7724	10	45	22	−27 50·2	„ 8·7–9·9
Th −33°·8559	12	34	12	−33 53·1	Certainly changed 9·1–9·5

The second of the stars in the above list has a period of probably forty-five days.

COMET 1886 V.—Several provisional elements of this comet, which was discovered by Mr. W. R. Brooks, have been calculated, and all have led to the assumption of a parabolic orbit. Mademoiselle Klumpke has, however, undertaken a determination of the definite orbit, using all the available data, and publishes a preliminary result of this computation in the *Bulletin Astronomique* for August. She has found that after two trials a parabolic orbit is untenable, but in her third attempt an elliptic orbit with a period of less than 1000 years was more conformable with the data. The elements finally deduced, but still subject to slight modifications, owing to the discussion of 250 observations now in hand, are as follows:—

T = 1886 June 7, 391319, Paris M.T.

$$\left.\begin{array}{llll} \pi = & 33^\circ & 54' & 49''\cdot77 \\ \Omega & 192 & 37 & 27\cdot37 \\ i & 87 & 40 & 23\cdot67 \end{array}\right\} \text{M. Equin. } 1886\cdot0.$$

$$\begin{array}{ll} \log e & 9\cdot998572 \\ \log q & 9\cdot431056 \\ \text{R.} & 745 \text{ years.} \end{array}$$

Mademoiselle Klumpke mentions that in her computation she has met with numerous difficulties in consequence of the great inclination of the orbit, and of the large heliocentric movement, which reached 245°.

EFFECT OF PRESSURE ON SERIES IN SPECTRA.—Prof. J. S. Ames and Mr. W. J. Humphreys publish in the *Johns Hopkins University Circular* (No. 130) a brief account of the results of an investigation to find out the effect of pressure on the lines composing series in the spectra of certain elements. To this end photographs were taken of the arc spectra of all the elements which give series at both ordinary and increased pressures. Eye observations were also made. The results were as follows: The lines of any one series of a particular element are shifted alike, that is, according to the same law which is given as

$$\Delta\lambda = \lambda\beta\,(p_1 - p_0)$$

where λ represents the wave-length, $\Delta\lambda$ the shift produced by the increase of pressure $p_1 - p_0$, and β is a constant for any one series of a definite element. The constant β is different for the different series of the same element, the change being such that, very nearly, β for the principal series is one-half β for the first subordinate, and one-quarter that of the second subordinate. Further, the constant β is different for the same series of different elements, and one apparent regularity which demands attention is that, approximately, the value of β for similar elements (that is, zinc, cadmium, mercury) varies as the cube root of the atomic weight.

In the same journal Mr. Humphreys communicates another note on changes of wave-length due to pressure, which contains some new and interesting observations; and some of the relations which he has found to hold good, may be briefly referred to here.

The shift towards the red is directly proportional to the total pressure of the gas. This shift seems nearly or quite independent of temperature (cyanogen bands excepted). The shifts of similar lines of a given element are proportional to the wave-lengths of the lines themselves. Analogous or similar lines of elements belonging to the same half of a Mendelejeff group shift proportionately to the cube roots of their respective weights. The wave-lengths of those substances which, in the solid form, have the greatest coefficients of linear expansion, have the greatest shifts. Finally, the shift of similar lines is a periodic function of atomic weight, and consequently may be compared with any